BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: B.TECH   SEMESTER: IV
BRANCH: MECHANICAL   SESSION : SP/2020

SUBJECT: ME251 THERMO FLUID ENGINEERING

TIME: 2 HOURS   FULL MARKS: 25

INSTRUCTIONS:
1. The total marks of the questions are 25.
2. Candidates may attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.

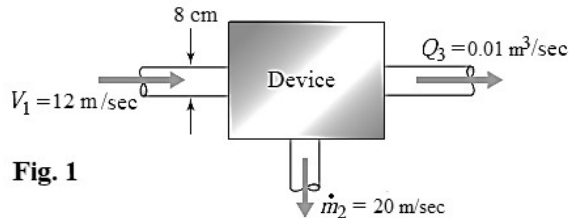|				CO	BL
Q1	(a)	Define clearly the local and convective acceleration with examples.	[2]	1	1
Q1	(b)	Derive an expression for the material derivative and explain clearly the physical interpretation of each term.	[3]	1	2, 6
Q2	(a)	Water flows out of the device as shown in Fig. 1. Calculate the rate of change of the mass of water (dm/dt) in the device.	[2]	1	3
Q2	(b)	Determine the conservation of mass from the Reynolds transport theorem and discuss the special cases in context to the compressible and incompressible flows.	[3]	1	3

Fig. 1

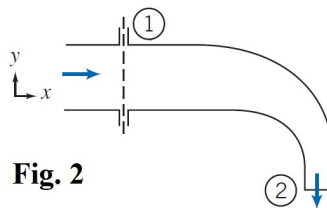|					
Q3	(a)	Derive an expression for the volumetric dilatation rate and explain its significance.	[2]	2	6
Q3	(b)	With a neat sketch, derive an expression for the angular motion and deformation of a differential fluid element.	[3]	2	6
Q4		In the case of rectangular parallelepiped, how would you derive the relation for the rate of shearing strains.	[5]	2	6
Q5		Water flows steadily through the 90° reducing elbow shown in Fig. 2. At the inlet to the elbow, the absolute pressure is 220 kPa and the cross-sectional area is 0.01 m². At the outlet, the cross-sectional area is 0.0025 m² and the velocity is 16 m/s. The elbow discharges to the atmosphere. Calculate the force required to hold the elbow in place.	[5]	3	3

Fig. 2

::::::: 04/03/2020 ::::::E